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$$x = \frac{m}{4} \left(-1 + \frac{1}{aa'} + \frac{1}{aa''} + \frac{1}{a'a''} \right), \quad y = \frac{m}{4} \left[3 \left(\frac{1}{a} + \frac{1}{a'} + \frac{1}{a''} \right) + \frac{1}{aa'a''} \right] \dots (11)$$

Considering AB and CD the given tangents, therefore a and a' given quantities, and a'' variable, we have in (11) only to eliminate a'' to obtain the equation of the required locus. Thus, putting for the sake of brevity $1/a + 1/a' = a$, $1/aa' = b$, we find the equation of the locus to be

$$4ay - 4(3-b)x = m[3(1+a^2) - b(4-b)].$$

Consequently, the locus is a straight line.

Also solved by G. B. M. ZERR.

165. Proposed by W. H. ECHOLS. B.Sc., S.E., Professor of Mathematics. University of Virginia. Charlottesville, Va.

$OB=b$, $OA=a$ are the semi-conjugate diameters of an ellipse. Draw BM perpendicular to and equal to OA , cutting it in N . Show that as M slides on the fixed line OM and N on OA the point B traces the curve.

Solution by the PROPOSER.

Let $M'N'B'$ be an arbitrary position of the line. Draw $B'Q$ parallel to Ox , join $M'Q$. Then

$$\frac{M'J}{JQ} = \frac{M'N'}{N'B'} = \frac{MN}{NB}.$$

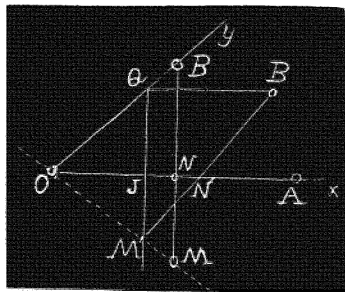
$\therefore M'Q$ is perpendicular to Ox .

Hence, if $B'Q=x$, $OQ=y$, we have

$$x^2 + (M'Q)^2 = a^2, \text{ or } x^2 + \frac{a^2}{b^2}y^2 = a^2.$$

$$\therefore x^2/a^2 + y^2/b^2 = 1.$$

Q. E. D.



166. Proposed by S. F. NORRIS. Professor of Astronomy and Mathematics. Baltimore City College, Baltimore, Md.

Two cities are 200 miles apart. To what height must a man ascend from one city in order that he may see the other, supposing the circumference of the earth to be 25,000 miles? [From Wentworth's *New Plane and Solid Geometry*, page 381, No. 619.] Required solution by Geometry.

Solution by DANIEL NORTHROP. Mandana, N. Y.

Let A be the position of one city and B the position of the second, distant on a straight line from A , $a=200$ miles. Let P be the position of the man above A when just able to see the city B , h his height above A . Draw the line PA and extend it through the center of the earth to the point D opposite A . Draw the line PB . Then we have $PB^2 = PD \times PA$, or $PB^2 = (h + 2R)h$.